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THE TEACHING OF MATERIA MEDICA

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PREPARATION OF DOSES FOR HYPODERMIC OR INTERNAL USE

Before discussing this subject at length, I might say that it would be well to inaugurate radical changes in the methods for calculation and preparation of medicinal doses for hypodermic use. The methods now in vogue in most institutions consist of calculating and preparing required doses from stock solutions of various strengths. Such stock solutions are generally used for reasons of economy. It would be better to have always on hand standard doses of the commonly used substances and their usual combinations in the form of tablets. To administer these tablets, it is only necessary for the nurse to dissolve one in m. x–xv of sterile water, draw up this solution into the hypodermic syringe and inject into the patient. I believe the tablets are now replacing stock solutions in many institutions and certainly in private nursing. It is to be hoped that this practice will soon become more general.

At the present time it is customary for the nurse to prepare required doses from stock tablets or from stock solutions. If the dose ordered corresponds to the dose of the tablet in stock or to that contained in a definite number of minims of the stock solution, the process of administration is simple indeed. Frequently, however, the required dose cannot be obtained by such simple measures. It is then necessary to devise means whereby the proper dose can be easily obtained and prepared. In my experience the following methods seem to be the simplest: For the preparation of the required dose from the stock tablet, it is only necessary to divide the stock dose into the required dose. We then use that fraction of a definite amount of sterile water in which the whole stock tablet is dissolved. For example, to give gr. $\frac{1}{150}$ atropine from a tablet of gr. $\frac{1}{100}$. Dividing $\frac{1}{150}$ by $\frac{1}{100}$ we get $\frac{2}{3}$. This is the fraction of the stock tablet to administer. We now dissolve the gr. $\frac{1}{100}$ tablet in m. xv of sterile water and draw up into the hypodermic syringe minums x which is $\frac{2}{3}$ of m. xv.

In preparing doses from stock solutions this method is too complicated, because we frequently find it necessary to deal with a number of drops or minims and fractions of a drop or minim in addition. To overcome this difficulty I have devised the following method which has given the best results at the institutions where I teach.

We reduce the smallest fraction of a grain contained in one drop of the stock solution, and the fraction of the grain required, to fractions with the same least common denominator. We then take one drop of the stock solution and add to that as many drops of sterile water, as is indicated by the difference between the numerator of the stock fraction and the numerator of its equivalent fraction. Of this newly-made solution we use as many drops of water as is indicated by the numerator of the required fraction when reduced to its equivalent fraction.

This rule seems rather formidable; but the expression of the processes involved in the calculation is more difficult than their actual performance. A few illustrations will readily demonstrate both the simplicity and rationale of the method.

For example, the nurse is required to prepare gr. $\frac{1}{150}$ of atropine from a 1 per cent stock solution. Each drop of the stock solution contains gr. $\frac{1}{100}$; the required dose is gr. $\frac{1}{150}$. Reducing both these fractions to fractions with the same least common denominators, we have:

$$\frac{1}{100}=\frac{3}{300}$$
$$\frac{1}{150}=\frac{2}{300}$$

We now take one drop of the stock solution, and add to that as many drops of water as are indicated by the difference between the numerators of $\frac{1}{100}$ and $\frac{3}{300}$ which is 2. Of this new solution we take two drops; the number indicated by the numerator of $\frac{2}{300}$.

What is the rationale of the method? We cannot measure gr. $\frac{1}{150}$ from the 1 per cent stock solution. We must prepare therefore a new solution of which each drop shall contain gr. $\frac{1}{300}$, because from such a solution we can measure accurately gr. $\frac{2}{300}$ or gr. $\frac{1}{150}$ its equivalent. This is contained in two drops of this new solution.

This method usually works well when doses less than that contained in one drop of the stock solution are to be administered. We shall encounter a difficulty, however, when we are to give a dose larger than that contained in one drop of the stock solution.

For example, the nurse is to prepare gr. $\frac{1}{75}$ of strychnine from a 1 per cent solution. According to our rule we have:

$$\frac{1}{100}=\frac{3}{300}$$
$$\frac{1}{75}=\frac{4}{300}$$

Therefore we take one drop of stock solution and add two drops of sterile water to that. From this resulting solution we are to give four drops. But this is greater than the total quantity of new solution prepared. The object, however, of taking one drop of stock solution and adding two drops of sterile water is to make up a new solution of which each drop shall contain gr. $\frac{1}{300}$ of strychnine. It does not matter, then, how much of such a solution we prepare, provided we maintain the same ratio between the amount of stock solution and the amount of added water. We multiply, then, the drop of stock solution and the amount of water to be added by any number which will make the total quantity of new solution greater than the number of drops of this new solution to be used. From this larger amount of new solution we may now use the requisite number of drops. In the particular problem under consideration we multiply the drop of stock solution and the amount of water which is to be added, each by 2. Thus we take two drops of the 1 per cent stock solution and add to this four drops of sterile water. We now have six drops of a new solution of which each drop contains gr. $\frac{1}{300}$. By taking four drops of this solution, we are giving the patient gr. $\frac{4}{300}$ or gr. $\frac{1}{75}$ of strychnine which is the required dose.

The study of solutions should not end merely with the calculation of the required amount of stock substance necessary to prepare a new solution or to administer a given dose. The pupil should be taught to perform the actual technique of measuring, dissolving, and administering, the required amounts or doses to be used. As soon as the methods have been mastered the pupils should be thoroughly drilled in solving numerous type problems. The instructor should select only those problems that are of practical value. Problems requiring the preparation of solutions that are seldom used or the preparation of doses which are infrequently given should be avoided.

The course on solutions should include a study of the basic principles of physical chemistry, such as diffusion, osmosis, dissociation, etc., as well as a study of the biological principles underlying the processes of absorption, excretion, etc. These processes form a definite basis for the proper methods of administering medicines and for a thorough understanding of many physiological and pathological processes. They can only be studied properly in the laboratory by actual demonstrations or the performance of suitable experiments.

I hope the time is not far off when every training school will be equipped with a laboratory specially fitted up for the study of solutions, where the pupils will be taught to perform every practical detail in the course on solutions as I have just outlined.

In many hospitals it is customary for the pharmacist to teach solutions, and often, too, in the hospital pharmacy. I believe this method should be discarded. The work on solutions which the nurse has to perform and the problems she has to contend with are not those of general pharmacy. Such work and the problems involved are peculiar to nursing and should be taught in a specially equipped laboratory for that purpose, and by someone, be it doctor, nurse, or pharmacist, who is in thorough sympathy with the problems to be solved and the difficulties to be encountered.

THE TEACHING OF MATERIA MEDICA AND PHARMACOLOGY

Materia medica and pharmacology should be taught in both the first and second year of training. I have already outlined the course for first year pupils. The second year course should be given in the form of class recitations in small classes. These classes should be given about once a week, for about thirty weeks, with four reviews at various times in the course.

The instructor should outline a detailed plan of work for the year at the beginning of the course. She should prepare the list of drugs to be studied, those to be taken up at each lesson, the time to be devoted to each, the ones to be emphasized, the method of study, etc. The teacher will find the class work itself simple indeed, if the pupils have already completed their courses in anatomy, physiology, and chemistry.

THE DRUGS TO BE STUDIED

Needless to say it is impossible to study all the drugs in the pharmacopoeia or National Formulary, in a limited course. Then too, there are a host of new and non-official drugs which are generally used and which the nurse is constantly administering to patients. Many of these substances also require consideration in class, if the work is to be kept up to date and if the teacher is to avoid being continually plied with questions about them.

The following plan of study is one that I have used in my classes with considerable success. It is arranged according to a definite pedagogic plan. The simplest substances are considered first, while the more complex ones are considered in the order of their complexity.

Lesson 1. Introductory remarks of preliminary course briefly reviewed, emphasizing nature of drug action, types of effect, such as local, general, pharmacological, toxicological, stimulation, depression, Classification.

Lesson 2. Local stimulants, such as mustard, capsicum, turpentine, cantharides, etc. Review function of stomach; gastric stimulants, such as bitters, digestives, emetics.

Lesson 3. Review function of intestines: cathartics.

Lesson 4. Review function of the blood and blood-forming organs: normal salt solution, iron, arsenic, and other drugs acting on the blood or blood forming organs.

Lesson 5–6. Review function of circulatory system: heart stimulants, digitalis group, caffeine, adrenaline, etc. (Lay special stress on digitalis.)

Lesson 7. Review cerebral function, cerebral stimulants, caffeine, and alcohol.

Lesson 8. Finish alcohol and take up cocaine.

Lesson 9. Strychnine (demonstrate effects on frogs).

Lesson 10. Take up briefly phosphorus, cod liver oil, and other general tonics.

Lesson 11. Pilocarpine and eserine.

Lesson 12. Uterine stimulants, ergot, pituitrin, etc.

Lesson 13. Diuretics (emphasize types).

Lesson 14. Review depression. Begin depressants, such as aconite, veratrum viride and nitrites. Emphasize practical uses and especially nitrates.

Lesson 15. Take up bromides and begin anaesthetics.

Lesson 16. Finish anaesthetics (emphasize).

Lesson 17. Hypnotics.

Lesson 18. Opium and morphine in detail.

Lesson 19. Antipyretics (emphasize their practical use) and toxicology.

Lesson 20. Gelsemium, valerian, lobelia and uterine sedatives, such as viburnum, etc.

Lesson 21. Discuss specific action and begin specifics. Take up quinine and begin mercury.

Lesson 22. Finish mercury and take up salvarsan and iodides.

Lesson 23. Salicylates, colchicum and atophan.

Lesson 24. Mention briefly vermicides, emphasize their administration. Begin acids and alkalies.

Lesson 25. Finish acids and alkalies and take up especially their toxicology.

Lesson 26. Study astringent action. Take up metallic and vegetable astringents.

Lesson 27. Study antiseptic action. Take up antiseptics.

Lesson 28. Local remedies: emollients, demulcents, etc.

Lesson 29. Serums, vaccines, etc.

Lesson 30. Organic remedies, radium, X-Rays, etc.

Lesson 31. The administration of remedies.

It will readily be seen from the above plan that the drugs are classified according to their principal effects. For the nurse I believe this to be the logical classification. The effects that drugs produce on patients are more important to her than the organs they principally effect.

The course should begin with a review of the preliminary considerations which have already been taken up in the first year. The types of effects should then be emphasized and the drugs to be studied should then be classified on this basis. They should be divided into two groups: stimulants and depressants, arranged according to the organs they principally affect.

Beginning with the stimulants causing the simplest effects, the members of each successive group should be studied in detail. Then the depressants should be taken up in the same order. Before studying the members of any group it is essential to briefly review the anatomy and physiology of the organs they principally affect and the effects of stimulation and depression on these organs.

I usually begin with the study of the drugs acting on the skin because their local effects are most readily understood. After a brief review of the anatomy and physiology of the skin we may study the results of its stimulation, such as capillary, dilation, excessive secretion of the glands and the resulting reflex effects. We then lead up to the effects of excessive stimulation such as vesicant action, escharotic action, etc. On this basis such local remedies as mustard, capsicum, turpentine, cantharides, etc., may be studied. The pupils have generally already seen the effects of mustard or turpentine so that the local effects which these substances produce will be readily understood. In studying the effects we should always attempt to visualize the changes which the substances induce both in the anatomy and physiology of the organ or tissue, and to express these changes in the simplest English.

We may now consider the substances which induce local effects in the mouth, stomach and intestines. The anatomy and physiology of these organs should first be briefly considered, as well as the changes in their function resulting from stimulation or depression. Thus we may show how a bitter causes an excessive secretion of digestive juices and the study of bitters may be taken up. Digestives may then be studied when the process of digestion has been elucidated. In a similar way the vomiting produced by excessive gastric stimulation or irritation may be explained and emetics considered. Cathartics are then taken up but are preceded by a study of the effects and *modus operandi* of the intestinal stimulation.

All the drugs studied thus far have produced only local effects. The study of drugs producing effects after absorption are now taken up. This should be preceded by a thorough study of absorption, excretion and the biological factors which have a bearing on these processes. We begin with the study of the anatomy and physiology of the blood and blood-forming organs and the effects of their stimulation or depression. Then we take up the drugs such as iron and arsenic that affect these organs. In gradual succession the heart stimulants, cerebral stimulants, secretory stimulants, uterine stimulants, diuretics, etc., may be studied. A preliminary consideration of the anatomy and physiology of the organs considered as well as the changes in their action which may result should always precede the study of the drugs themselves.

When the stimulants have been considered the depressants may be taken up in the same manner. Then the other drugs outlined in the above curriculum may be taken up consecutively. In the last class, when the pupils are more mature and have already studied most of the drugs in detail, we may take up the science and art of the administration of medicines and the underlying principals.

MOTION PICTURES FOR THE INSANE

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What is the effect of motion pictures on the insane? This is best summed up in the words of a famous asylum superintendent: "It makes life comfortable, both for the afflicted and for those who have the care of them." Several institutions have proven the above statement by actual experience. In all cases comedy has had the most beneficial effect upon feeble-minded folks, who are apt to give way to brooding, so since their minds can be diverted to the merry side of life, much has been accomplished. Drama is not appreciated, for it seems too involved for the insane to understand, yet, on the other hand, educational subjects are followed with interest, and after the performance it is not unusual for patients to ask all sorts of questions pertaining to the same. The intelligence, however, has to be worked up on a gradual scale. First simple comedies are shown, the next step being the educational.

It is not long before the patients develop into enthusiastic motion picture fans. They anticipate the shows far in advance; watch the screen intently and applaud every picture. Not all patients are in the same condition; it has been found best to try the pictures with those least affected.

At the Central State Hospital of Lakeland, Ky., for instance, a motion picture entertainment is given in the large auditorium every Tuesday evening, when white patients constitute the audience. Colored patients are regaled with a similar program each alternate Wednesday night. At the Eastern Oregon State Branch Hospital, performances are given twice weekly. The orchestra which accompanies the pictures is formed of hospital employees.